49. *Monodromy Preserving Deformation and Its Application to Soliton Theory. II*

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§ 1. **Introduction.** This is a sequel of the preceding papers [1], [2]. In the previous article [2], the author showed that the multi-soliton solutions of the sine-Gordon equation are governed by the iso-monodromic deformation equations. The purpose of the present note is to extend the result in [2] to the Pohlmeyer and Lund-Regge system (PLR) [3], [4]

$$(1.1)\qquad u_{\xi\eta}-\frac{v_\xi v_\eta \sin(u/2)}{2\cos^3(u/2)}+\sin u=0,$$

$$v_{\xi\eta}+\frac{u_\xi v_\eta+u_\eta v_\xi}{\sin u}=0$$

and the non-linear Schrödinger equation (NLS)

$$(1.2)\qquad u_\eta-iu_{\xi\xi}-2i|u^2|u=0.$$

The multi-soliton solutions of these equations are related to the monodromy preserving deformations of the following 2×2 first order systems, respectively:

$$(1.3)\qquad PY=0,\qquad P=\frac{d}{dx}-\left(G+Fx^{-1}+Ex^{-2}+\sum_{j=1}^{N}\frac{H_j}{x-a_j}\right),$$

$$(1.4)\qquad PY=0,\qquad P=\frac{d}{dx}-\left(Gx+F+\sum_{j=1}^{N}\frac{H_j}{x-a_j}\right).$$

The reader is referred to the previous paper [2], in which the deformation theory for the above equations was developed.

Another purpose of the present note is to investigate the Hamiltonian structure of the deformation equations for the above systems (1.3) and (1.4), and to calculate explicitly the "τ-function" in the case of PLR and NLS (cf. [8], [9], [10]). It is known that these "τ-function" are deeply connected with the Fredholm determinant of Gelfand-Levitan-Marchenko equation linearlizing PLR and NLS (cf. [10]).

§ 2. **Application to PLR and NLS.** PLR (1.1) is equivalent to the compatibility condition of the system of differential equations (cf. [3], [4])

$$(2.1)\qquad \left(\frac{\partial}{\partial\xi}-i\begin{bmatrix} & -a^* \\ -a & \end{bmatrix}-ix/2\begin{bmatrix}1 & \\ & -1\end{bmatrix}\right)Y=0,$$